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Numerical Study of Spin-1/2 XXZ Model on Square Lattice from Tensor Product States(New Development of Numerical Simulations in Low-Dimensional Quantum Systems: From Density Matrix Renormalization Group to Tensor Network Formulations)

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# Numerical Study of Spin-1/2 $XXZ$ Model on Square Lattice from Tensor Product States

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By means of the recently proposed algorithm [1, 2] based on the tensor product states, the magnetization process of the spin-1/2 anti-ferromagnetic  $XXZ$  model on a square lattice is investigated [3]. In the large spin-anisotropy limit, clear evidence of a first-order spin-flip transition is observed as an external magnetic field is increased. Our findings of the critical field and the discrete jumps in various local order parameters are in good agreement with the quantum Monte Carlo data in the literature. Our results imply that this algorithm can be an accurate and efficient numerical approach in studying first-order quantum phase transitions in two dimensions.

Recently, this algorithm has been applied with success to several quantum spin systems [1, 2, 4, 5] including even frustrated ones [6]. It shows that this numerical approach can be a useful tool with wide applications.

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